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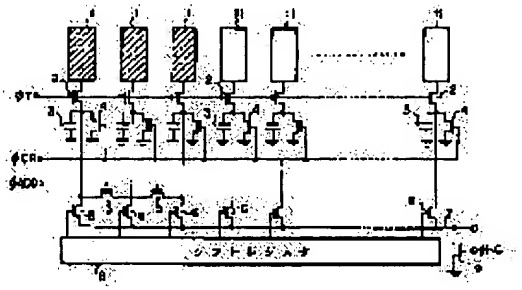
(54) SOLID-STATE IMAGE PICKUP DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an image signal with less density unevenness by applying addition and averaging processing to an output from a plurality of photoelectric conversion elements whose receiving light is shut in a storage means so as to obtain a reference output thereby eliminating the effect of random noise.

SOLUTION: A picture element signal stored in lots of photoelectric conversion elements 1, 11 is read by a clamp capacitor(CT) 3 by making a switch transistor(TR) 2 conductive with a transfer control pulse ϕT and is stored as a picture element signal. When an averaging switch TR 5 is conductive by an averaging control pulse ▵DD, the picture element signal read from a plurality of the photoelectric conversion elements (OB elements) 1 whose light is shut to the CT 3, then the signals become charges of the same level and added and averaged. As a result, a reference output is obtained from which the effect of random noise generated from the OB elements 1 is reduced. A switch TR 6 is scanned by a shift register 8 and in the case of reading the image signal in the CT 3 on the common read line sequentially, a difference from the reference output is extracted.



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* NOTICES *

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the solid state camera used for the picture reading sections, such as a copying machine and facsimile.
[0002]
[Description of the Prior Art] To a solid state camera, as a solid state image pickup device or an optoelectric transducer, conventionally A CCD type, As a line sensor which various elements, such as a photodiode type, a bipolar transistor type, and an MOS type, are being developed and adopted, and arranges a majority of these elements on a semiconductor chip at one line It is utilized as an area sensor arranged in the shape of two-dimensional. the former A manuscript picture is read for every line, and a manuscript is moved, or a sensor system is moved, and it carries out [a manuscript picture is read, and / **** / imprinting and copying a picture signal to a photo conductor / this manuscript picture signal is written in transferred paper, or], and is used for image sensors, a copying machine, facsimile, etc. Moreover, as an area sensor, colorful practical use continues [, such as a video camera, an expansion camera, and a video microscope,] to be expected towards the time of multimedia.
[0003] Such a solid state camera bundles up this pixel charge by one line with the above-mentioned solid state image pickup device which carries out photo electric translation and generates a pixel charge, and has the example which consists of accumulation meanses, such as a capacitor (capacity) accumulated for every pixel temporarily, and a transfer means to output this pixel charge one by one serially by the timing signal from a horizontal scanning circuit.
[0004] In solid state cameras which make a pixel such two or more optoelectric transducers, respectively, such as a line sensor and an area sensor, some pixels are shaded among many pixels, the difference of this normal output is taken from the pixel signal with which alumnus pixel signal is made into a normal output as an optical black pixel ("alumnus pixel" is called hereafter), and others are not shaded in the these-shaded pixel, and, generally using as a regular sensor signal is performed. The clamping circuit which makes the method using the signal from this alumnus pixel as a normal output, for example, is shown in (a) of drawing 2 is raised. In drawing, 21 is clamp capacity and 22 is a switch transistor. In this view, the sensor output of the pixel charge of an optoelectric transducer is inputted, this pixel charge is accumulated temporarily at the clamp capacity 21, a low pulse is impressed to clamp-pulse phiCLP as a timing signal from a horizontal scanning circuit etc. after that, the switch transistor 22 is turned off, and the clamp output of the charge of the clamp capacity 21 is carried out.
[0005] The sensor output shown in this clamping circuit at (b) of drawing 2 is inputted, if phiCLP is added during the alumnus output as shown in this drawing, the sensor output of alumnus pixel will serve as a reference signal, and the component indicated with a slash to be the regular sensor outputs S1, S2, and S3 etc. to this drawing will be taken out as an effective signal output component.
[0006] By the way, conventionally, when it had two or more alumnus pixels, the signal from these alumni pixel was outputted one by one as it was for every pixel.
[0007] For this reason, when using the aforementioned clamping circuit, in order to base that the normal output of alumnus pixel is decided on an output when clamp-pulse phiCLP changes from High to Low, It had become an output from a single pixel (0 B pixel alumnus3 in this case) to be used as a normal output, though the impression time of clamp-pulse phiCLP is added from three alumnus pixels shown in

this drawing to the output from two or more alumnus pixels as shown in (c) of drawing 2 .
[0008]
[Problem(s) to be Solved by the Invention] By the way, random noise is contained in the output of shaded alumnus pixel. Therefore, when the output from single alumnus pixel was made into the normal output at this appearance, there was a fault that the random noise which specific alumnus pixel generates was reflected in a normal output as it is. In a line sensor, whenever it reads the random noise of one line in a normal output, it is equivalent to a normal output changing at random, and it becomes the cause by which an output picture produces concentration unevenness for every line in the scanning direction of a sensor. Then, in solid state cameras which have two or more pixels, such as a line sensor and an area sensor, the purpose of this invention is by making small influence which the random noise which alumnus pixel generates has on a normal output to acquire the few output picture of concentration unevenness, when using the output of alumnus pixel as a normal output. Moreover, it aims at acquiring the picture signal of an effective pixel without a fixed pattern noise and concentration nonuniformity by obtaining a normal output, after obtaining the differential signal of a noise component and a signal component also in each alumnus pixel.
[0009]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, this invention is characterized by to perform averaging-ized processing on the aforementioned accumulation means for the output from the two or more aforementioned optoelectric transducers shaded in the solid state camera by which some [at least two or more] optoelectric transducers were shaded among the aforementioned optoelectric transducers in the solid-state picture equipment which has two or more accumulation meanses accumulate the signal outputted from two or more optoelectric transducers, respectively.
[0010] in this way, the thing for which equalization processing will be performed if random noise which each alumnus pixel generates is set to V [a Vr.m.s:effective voltage] -- random noise -- square -- since it is averaged, the random noise after equalization, i.e., the random noise of the aforementioned normal output, is set to V/rootN [Vr.m.s] (the number of alumnus pixels with which N equalized), and it decreases to 1/rootN Consequently, the concentration unevenness of the aforementioned output picture is improved.
[0011] Moreover, in the above-mentioned solid state camera, it is characterized by obtaining a normal output by an accumulation means being equipped with the capacity the object for the noise components from each optoelectric transducer, and for signal components, averaging--ization-processing the pixel signal of this capacity, respectively, and carrying out the differential output of the output signal for each components. Moreover, in the above-mentioned solid state camera, after averaging-ized processing accumulates a pixel signal for the accumulation means corresponding to the shaded optoelectric transducer, it is characterized by communalizing the pixel signal of each accumulation means by the solid state switch means.
[0012]
[Embodiments of the Invention]
(1st operation gestalt) It explains, referring to a drawing about the 1st operation gestalt by this invention. The 1st operation gestalt of this invention is shown in drawing 1 . The switch transistor for two or more optoelectric transducers (alumnus pixel) by which 1 was shaded, and 2 reading the signal from an optoelectric transducer to a storage capacitance in this drawing, The reset switch transistor for 3 resetting the clamp capacity (CT) as a storage capacitance, and 4 resetting the clamp capacity CT 3, The equalization switch transistor for 5 averaging-izing the signal on the clamp capacity CT 3, The read-out switch transistor for 6 reading the signal on the clamp capacity CT 3 to the community read-out line 7, The shift register as a horizontal scanning circuit for the community read-out line by which 7 was connected to the OUT terminal, and 8 opening and closing the switch transistor 6 one by one, The reset switch transistor for 9 resetting the community read-out line 7 and 11 are optoelectric transducers (effective pixel) which are not shaded among the optoelectric transducer arranged on the line. [many]
[0013] After resetting and initializing optoelectric transducers 1 and 11 by the non-illustrated reset circuit in this composition, through fixed time, the pixel signal accumulated at these optoelectric transducers adds a high pulse to transfer control pulse phiT, and reads it to the clamp capacity CT 3

which bundled up by making it flow through the switch transistor 2, and was connected to each optoelectric transducer, and a pixel signal is accumulated. Next, after [the switch transistor 2] un-flowing, the pixel signal read from the alumnus pixel 1 to the clamp capacity CT 3 is averaging-ized by adding a high pulse to equalization control pulse phiADD, and making it flow through the equalization switch transistor 5. Consequently, each picture signal of the clamp capacity CT 3 corresponding to the alumnus pixel 1 in the random noise generated by the time it read the pixel signal to the clamp capacity CT 3 will accumulate the charge of the same level, and it will be equalized.

[0014] Then, the picture signal on the clamp capacity CT 3 is outputted to an OUT terminal one by one through the community read-out line 7 by supposing un-flowing the switch transistor 5, reading with a shift register 8, impressing a high pulse and scanning the switch transistor 6 to the alumnus pixel 1 and the effective pixel 11 which is not shaded, respectively. In addition, the community read-out line 7 is reset through the switch transistor 9 by adding a pulse to reset pulse phiHC every, after reading the picture signal on each clamp capacity CT 3. After reading the signal of all the pixels on one line, add a high pulse to control pulse phiCR, it is made to flow through the switch transistor 4, and a series of operation is ended by resetting the clamp capacity CT 3. This operation of a series of is made into a round term, and a series of above-mentioned operation is repeated successively.

[0015] If equalized alumnus pixel output with which equalization, i.e., random noise, was reduced for the random noise by two or more alumnus pixels 1 according to this operation gestalt will be obtained and this is used for a normal output, the few output picture of concentration unevenness will be acquired. Although the above-mentioned operation gestalt showed the example of three alumnus pixels By two pieces or two or more n alumnus pixels being sufficient, forming the equalization switch transistor 5 of an individual (n-1) in each output lines of both in that case, and impressing equalization control pulse phiADD By being able to acquire the picture signal by which random noise was averaged more, and taking out a difference with a normal output from the pixel signal of the effective pixel 11 with which others are not shaded by making this picture signal into a normal output The picture signal corresponding to the object picture can be acquired among a picture signal including the so-called dark signal.

[0016] (2nd operation gestalt) The 2nd operation gestalt of this invention is shown in drawing 3 . In this drawing, 10 is a highway which connects switch transistor 5 comrades for CT addition. The same sign is attached about the same composition member as drawing 1 , and detailed explanation is omitted.

[0017] Moreover, although operation of this operation gestalt is the same as that of operation of the 1st operation gestalt, in case the picture signal of the alumnus pixel 1 is added on the clamp capacity CT 3, it differs at the point performed through a highway 10. That is, after [the switch transistor 2] un-flowing, by adding a high pulse to equalization control pulse phiADD, and making it flow through each switch transistor 5 for CT addition simultaneously, the pixel signal read to the clamp capacity CT 3 which corresponds from the alumnus pixel 1 is averaging-ized, and the picture charge corresponding to this averaging-ized picture signal is reaccumulated at those clamp capacity CT 3. Then, it flows through each read-out switch transistor 6 in time series, and the charge of the clamp capacity CT 3 is outputted to the community read-out line 7 by the timing signal from a shift register 8 at Terminal OUT.

[0018] In this way, also in this operation gestalt, equalized alumnus pixel output with which the random noise of alumnus pixel was reduced will be obtained, this is used for a normal output, the few output picture of concentration unevenness is acquired, and the same effect as the 1st operation gestalt is acquired.

[0019] (3rd operation gestalt) The 3rd operation gestalt of this invention is shown in drawing 4 . This drawing arranges two circuits after the optoelectric transducer of drawing 1 for every optoelectric transducer, and makes them the composition which takes the difference of the output of each system. give each number among drawing -- the sign of ****** A and B should show distinction of each system, and should attach the same number as drawing 1 -- a ****** thing shows the same composition member In addition, 21 shows the differential circuit which is connected to the community read-out lines 7A and 7B, and acquires the difference signal. In case this composition removes a fixed pattern noise (FPN), especially, it is used effectively and operates as follows.

[0020] In drawing 4 , after initializing optoelectric transducers 1 and 11, a high pulse is immediately added to noise transfer pulse phiTN, it bundles up by making it flow through switch transistor 2B, and

the signal immediately after initialization is read to clamp capacity CTN3B. Under the present circumstances, the read picture signal becomes the fixed pattern noise itself, and is accumulated to clamp capacity 3B by making this into N component picture signal. after [then, / switch transistor 2B] un-flowing -- again -- optoelectric transducers 1 and 11 -- initializing -- fixed time -- back -- it reads to clamp capacity CTS3A collectively by adding a high pulse for the signal accumulated at these optoelectric transducers 1 and 11 to signal transfer pulse phiTS, and making it flow through switch transistor 2A Under the present circumstances, the read signal becomes what added FPN to the signal component accumulated at each optoelectric transducer, and makes this an S+N component picture signal. In addition, when it is the optoelectric transducer in which destructive read is possible, after reading N component, it is not necessary to initialize an optoelectric transducer again. Next, after [switch transistor 2A] un-flowing, the picture signal read from alumnus pixel to clamp capacity CTS3A and CTN3B is averaging-ized, respectively by adding a high pulse to equalization control pulse phiADD, and making it flow through the switch transistors 5A and 5B.

[0021] Then, the picture signal on clamp capacity CTS3A and CTN3B is outputted one by one through the community read-out lines 7A and 7B, respectively by supposing un-flowing the switch transistors 5A and 5B, and carrying out the flow scan of the switch transistors 6A and 6B with a shift register 8. By outputting these picture signals, i.e., an S+N component picture signal, and N component picture signal through a differential circuit 21, it becomes (S+N)-N=S, only S component is outputted and FPN is removed for alumnus pixel and an effective pixel.

[0022] In addition, the community read-out lines 7A and 7B are reset through the switch transistors 9A and 9B by adding a pulse to reset pulse phiHC every, after reading the picture signal on each clamp capacity CTS and CTN. In this way, after reading the signal of all pixels, by adding a high pulse to reset control pulse phiCR, it is made to flow through the switch transistors 4A and 4B, and a series of operation is ended by resetting the charge of each clamp capacity CTS3A and CTN3B. This operation of a series of is made into a round term, and this is repeated successively.

[0023] If alumnus pixel output with which equalization, i.e., random noise, was reduced for random noise according to this operation gestalt will be obtained and this is used for a normal output, while the few output picture of concentration unevenness will be acquired, a fixed pattern noise (FPN) is also removable.

[0024] (4th operation gestalt) The 4th operation gestalt of this invention is shown in drawing 5 . This drawing allots two circuits after the optoelectric transducer of drawing 3 for every optoelectric transducer, and makes them the composition which takes the difference of the output of each system. give each number among drawing -- the sign of ****** A and B should show distinction of each system, and should attach the same number as drawing 3 -- a ****** thing shows the same composition member and omits detailed explanation In addition, it connects with the community read-out lines 7A and 7B, and 21 shows the differential circuit which acquires the difference signal. Moreover, although operation of this operation gestalt is the same as that of operation of the 3rd operation gestalt about the output of each system, in case it adds the signal of alumnus pixel on the clamp capacity CTS and CTN, respectively, it differs at the point performed through Highways 10A and 10B, respectively.

[0025] Namely, after accumulating the pixel signal of alumnus pixel and an effective pixel in each clamp capacity first, By adding a high pulse to equalization control pulse phiADD, and making it flow through each switch transistors 5A and 5B for CT addition simultaneously, after [switch transistor 2A and 2B] un-flowing The pixel signal read to clamp capacity CTS3A which corresponds from the alumnus pixel 1, and CTN3B is averaging-ized, and the picture charge corresponding to this averaging-ized picture signal is reaccumulated at those clamp capacity CTS3A and CTN3B. Then, it flows through each read-out switch transistors 6A and 6B in time series, and the charge of clamp capacity CTS3A and CTN3B is outputted to community read-out line 7A.7B by the timing signal from a shift register 8, the differential amplifier of the pixel signal of each community read-out line 7A.7B is carried out by the differential circuit 21, and it is outputted to Terminal OUT.

[0026] Also in this operation gestalt, while the normal output by which random noise was equalized is obtained like the 3rd operation gestalt and the few output picture of concentration unevenness is acquired by outputting the pixel signal of each pixel which exceeds a reference signal on the basis of this, a fixed pattern noise (FPN) is also removable.

[0027] In addition, a reference signal is inputted into the picture signal acquired according to the above-mentioned operation gestalt by the clamping circuit of the output latter part of this solid state camera, and it can acquire easily the picture signal which exceeds this clamp voltage for a reference signal as a clamp voltage of a clamping circuit.

[0028] Moreover, especially in the above-mentioned operation gestalt, although the line sensor was explained to the example, it is applicable also about an area sensor. That is, it classifies into a matrix at alumnus pixel and an effective pixel among the chip of optoelectric-transducer loading arranged in the shape of [which was manufactured at the same process] two-dimensional, a gobo or a shading film is given to alumnus pixel portion, the reference signal of a clamping circuit is switched for every alumnus pixel read-out during 1 horizontal scanning period, an active principle is outputted from the pixel signal of the continuing effective pixel, and 1 field signal of 1 perpendicular period can be acquired. Moreover, if each field signal is compared, since the difference in each train direction in one line arises and the concentration nonuniformity of this direction of a train will be cut down, by making two or more lines of the beginning into alumnus pixel, vertical alumnus pixel can be averaging-ized, it can consider as a reference signal, this reference signal can be supplied to the clamping circuit for the fields connected to the latter part, and the concentration nonuniformity generated for every field can be prevented.

[0029] Moreover, in the above explanation, although the output of all alumnus pixels is set as the object of averaging-izing, of course, you may use only the output of some alumnus pixels for averaging-ization. For example, it is more more desirable not to make into the object of averaging-izing the output which is alumnus pixel from which alumnus pixel in alumnus pixel or the very end which adjoins an effective pixel etc. is effective, and other alumnus pixels and a surrounding situation differ, since the relation with an effective pixel is thin.

[0030]

[Effect of the Invention] If alumnus pixel output with which equalization, i.e., random noise, was reduced for solid-state-camera **** by this invention and random noise will be obtained and this is used for a normal output as explained above, the few output picture of concentration unevenness will be acquired. Moreover, a dark output and the Ming output can be outputted from each pixel, respectively, and a fixed pattern noise can be cut down by obtaining the normal output concerned, and a picture signal with little concentration nonuniformity can be acquired.

[Translation done.]

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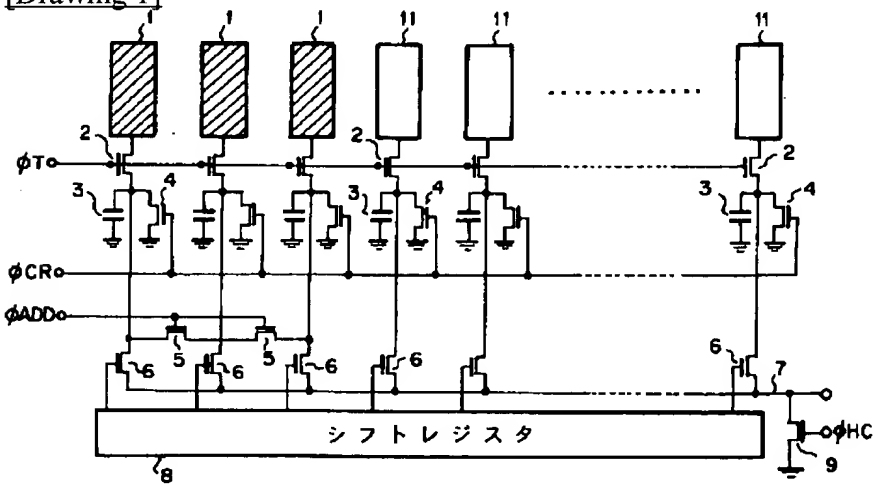
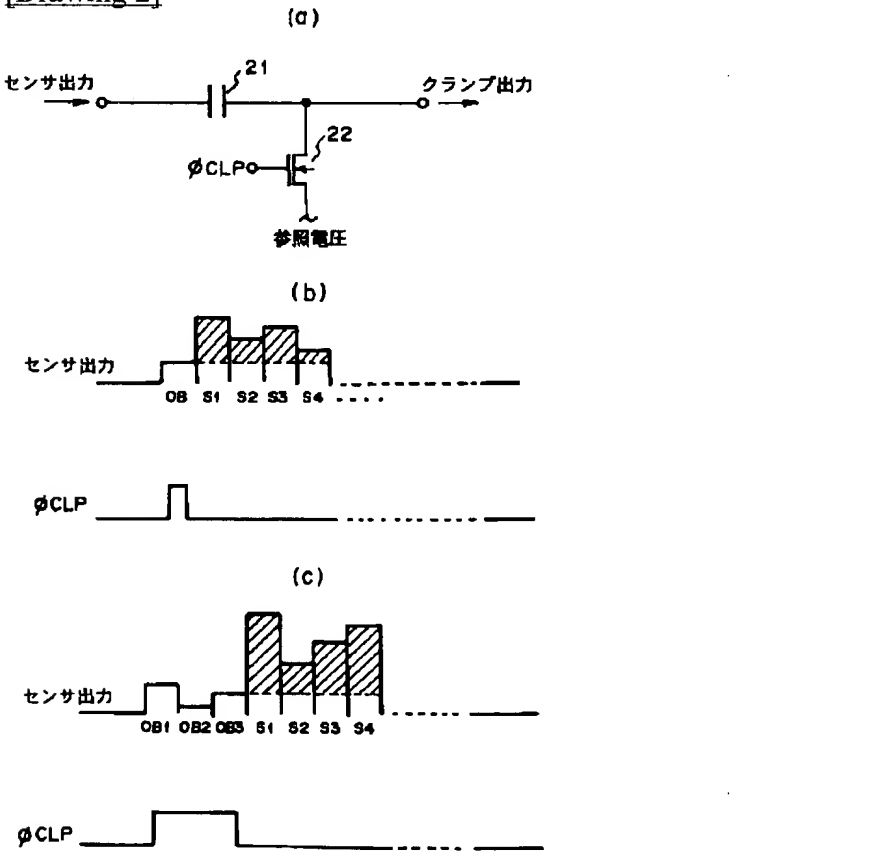
DRAWINGS

[Drawing 1]



[Drawing 2]



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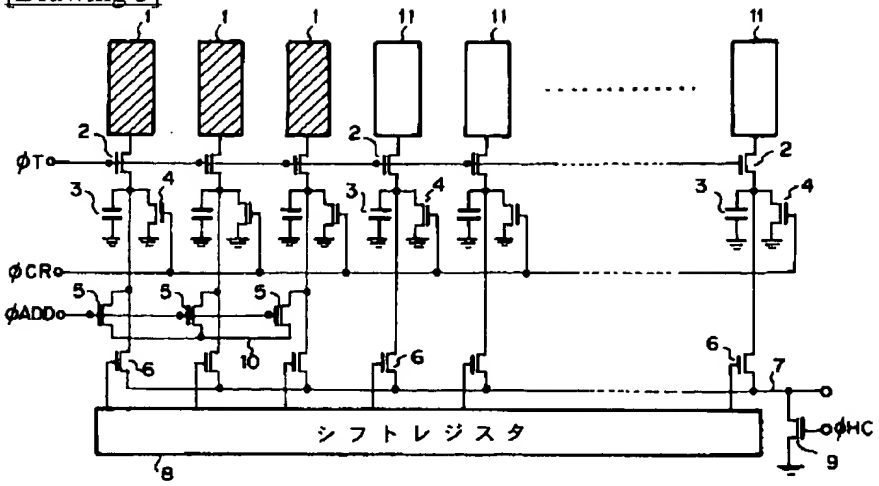
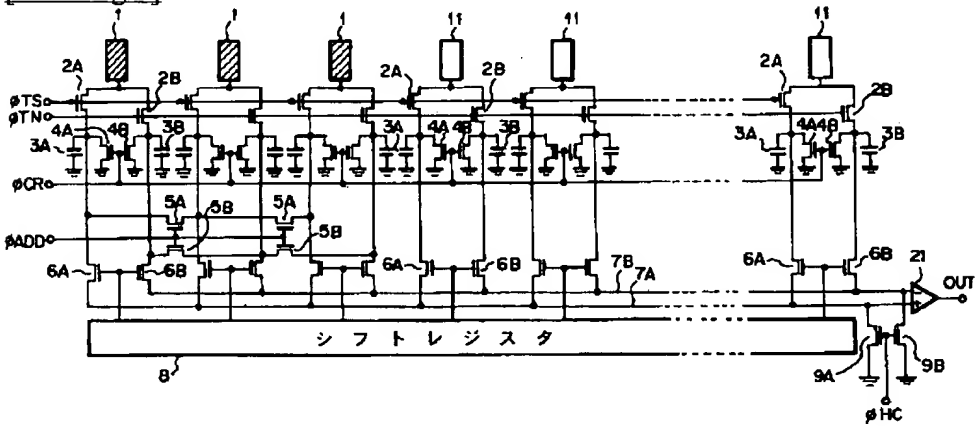
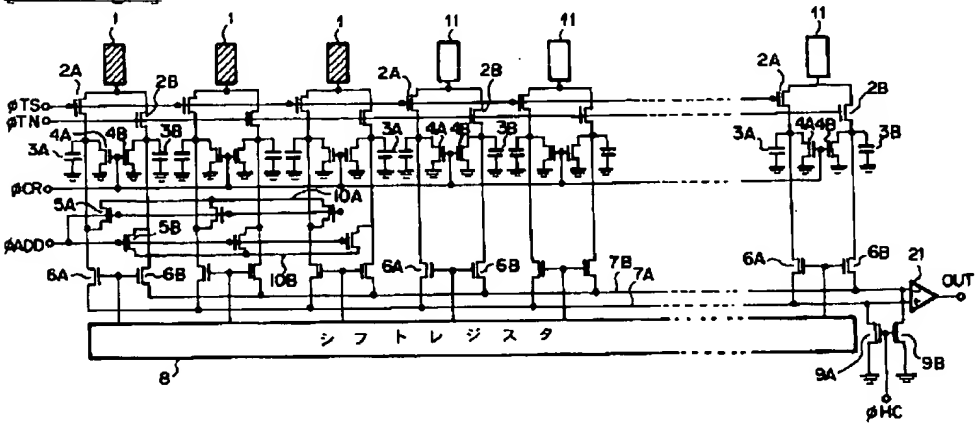
[Drawing 3]



[Drawing 4]



[Drawing 5]



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